ical analysis shows that this stone contains rock salt and niter, which are hygroscopic. When they absorb the vapor from moist air the surface becomes black, but in dry weather the moisture evaporates from the surface and leaves a little of the salt, which has been brought from the interior of the stone, in white spots on the surface. The color of the stone is therefore due to its irregular absorption of the moisture in the air, and it should be called a hygroscope rather than a barometer.

The Editor would be glad to receive any confirmation of the preceding newspaper paragraph.

PECULIAR MOUNTAIN STORMS.

In the MONTHLY WEATHER REVIEW for May, 1897, page 212, will be found a letter from Mr. Joseph H. Struble, of Uniontown, Fayette County, Pa., latitude 39° 45' N., longitude 79° 45' W., relative to an interesting local phenomenon. The following additional letter has been received from him on the same subject:

> We have in this locality a peculiar kind of what we call an eastern or mountain storm, of frequent occurrence, and which lasts from twenty-four to thirty-six hours. The first indication of the approaching phenomenon is the wind veering from north to east, and when due east it blows with great violence, apparently from over the crests of the Laurel Hill Range of mountains; apparently the storm is principally confined to a distance of about 2 or 3 miles along and from the base of the mountain, but prevails a considerable distance, running north and south at the base. This storm is not noticed east of the mountain or 4 miles from its base. When the storm works south, it ceases and winds up in rain, but never works north. The height of Laurel Hill Mountain Range is from 2,843 to 2,500 feet above the Atlantic Ocean. Uniontown is about 952 feet above sea level, on the National or Cumberland road. The storms alluded to are of more frequent occurrence in the fall and winter season of the year. I have noticed that ice would form on the trees about halfway down the mountain, showing a colder atmosphere on the top of the mountain than at its base during the winter season of the year. If you can tell me where I can obtain a description and explanation of the cause of such strange phenomena, or throw all the light necessary to explain the matter yourself, I will be obliged.

The Editor has already stated, in the REVIEW for May, 1897, that he hesitates to undertake an explanation of any meteorological phenomenon without a reasonable assurance that he is in possession of all the principal facts of the case. It is very much to be desired that Mr. Struble and others make a meteorological study of the region where these interesting stormwinds occur. What we wish to know is the temperature and moisture of the air, the strength and direction of the wind, and the location and motion of the clouds, for some distance east and west of the mountain storm region. It would be especially interesting if some one would fly a small kite on the summit of the Laurel Hill Range and, also, at several points on the western slope. We think it will be found that, even though no strong wind is blowing near the ground between the summit and the belt of stormwinds in the valley at the base of the mountain, yet such a wind will be found a short distance above the ground. Whenever a strong wind blows over a mountain range, it descends a little on the leeward side, and, under certain conditions, may descend like an invisible waterfall to the ground in the valley below. Of course, in such cases, a thin current of warm air clings to the leeward slope of the mountain, while the heavier upper air glides over it down into the valley below. If this descending air is cloudy at the start, then the evaporation of the cloudy particles will keep it cool until it reaches the valley, thereby neutralizing the warmth produced by the compression of the descending air. As the Laurel Hill Mountain Range is from 1,500 to 1,900 feet above Uniontown, the descending air may be warmed up at least 10° F. by compression. The barometer at Uniontown must be 1.5 or even 2 inches higher than at the top of the mountain. A cloud at the top of the mountain whose temperature is 32° F., and which is, therefore, composed of particles of water that are ready to turn into ice whenever they come into contact with any solid substance like the branches of the trees, would, if carried down with the descending winds, deposit ice or sleet during the upper half of its course, but, eventually, having evaporated the remaining particles, would strike the bottom lands as a raw wind whose temperature is slightly above 32°, and, therefore, warmer than the air halfway up the mountain.

A mountain range is not absolutely essential to the formation of these descending currents, they form a very conspicuous feature on the southwest and southeast sides of every general storm center, where cold, cloudy air is systematically pushed rapidly forward over warm, moist layers near the ground; of course, eventually the denser air descends, sometimes rapidly and sometimes on a very gentle decline. The rapid descents give us the gusty weather and the spits of snow or dashes of rain that precede the approach of the cold wave or the belt of clearing, cool, dry weather; the gentle descents give us a beautiful series of undulations in the thick stratum of clouds that may extend from 100 to 500 miles over the land. In general, the violent short-lived gusts on land and sea, whether in the midst of general storms or in clear, dry weather, represent masses of air that are descending by their own density through the surrounding air, and at the same time going forward with considerable velocity. When such descending masses strike the earth, they roll along for a short distance, the barometer suddenly rises a little; the denser air lifts up the warmer air, spreads out in all directions, and keeps its place permanently near the earth as a thin, flat layer until, having received a little heat from the soil or the ocean, it is ready to be pushed up by the next cold gust that descends. This process goes on perpetually in the atmosphere on every scale of magnitude; the little "catspaws" on the water, the flurries of dust on the roadway, the fœhn and the dry chinook winds, the gusty winds with spits of snow in the spring and autumn, the gusts with which the cold waves or northers begin, the straight line gusts that Hinrichs calls "derecho," the gusts that precede thunderstorms, the harmattan and the tornadoes of the west coast of Africa, the pamperos of South America, the trade winds of the tropics, are among the many illustrations of descending winds, some of which continue as horizontal winds for a long time after they reach the earth.

In a mountainous country where the hills are arranged in ridges so regularly as throughout the Appalachian Range, there is, so far as we can see, no reason why there should not be many cases similar to that of Uniontown. The descending air over Uniontown should, as it proceeds westward, rise again and, eventually, form a cloud, even if there be no special hill to the westward. In Espy's "Philosophy of Storms," page 552, a book that will, doubtless, be easily accessible to any voluntary observer in Pennsylvania, the so-called Helm wind of Crossfell, England, is explained essentially as follows: The Crossfell range of hills runs nearly north and south; when a violent east wind blows, the air on the west, or leeward slope, curves downward, as it does in passing across a hollow between two mountains, and is felt over a long narrow region on the west side of the mountain range. Over this windy region there is no cloud, but on the west of this region a distinct cloud is seen, always in the same position and called the "Bar," while on the east side of this region there is a cloud called the "Helm." This Helm cloud is simply the bold, clearly defined end of a series of clouds or a roll of clouds extending eastward behind the Helm. A similar series of clouds extends westward from the Bar. The open space overhead between the Helm and Bar extends 5, 10, or even 30 miles north and south, and is from one-half to five miles wide. It is simply an elliptical opening over the region where the descending cloudy air is so warmed up by its descent that the cloud mostly disappears; only small pieces are occasionally seen, passing rapidly from the Helm over to the Bar, showing that a strong east wind prevails there. Above this open space, in the open stratum of clouds, one may often see a higher stratum which is evidently so high up that it is above the influence of the valley and the lower winds.

LUNAR RAINBOW.

A brilliant lunar rainbow was observed at Louisville, Ky., on February 27, between 8 and 10 p. m. As described by Weather Bureau Observer O'Connor a small circle appeared first, formed in the thin fibrous clouds that were moving from west to east. As these spread over the heavens a large circle of about 40° in diameter was observed encircling the zenith at 8:20 p. m. As the moon descended in the west this circumzenithal circle increased in diameter until at 9:10 p. m. it was about 60° in diameter, after which it began to fade away in the east, and by 9:50 had entirely disappeared. The circle about the moon itself at no time exceeded 6° in diameter. When first formed it appeared to be a true circle, but as the moon approached the horizon it became oblong and finally, before disappearing, had dwindled into a mere line, passing vertically through the moon at about 10 p. m. In the earlier stages the circle around the zenith had a greenish tint.

WATERSPOUT.

According to an extract from the San Francisco Call, the British bark *Fairfield*, of Glasgow, encountered on her trip between Shanghai and Tacoma a waterspout and hurricane that stripped her bare of canvas. The *Fairfield* passed within a quarter of a mile of this waterspout when about a week out from Shanghai, viz, on February 10. The sky became suddenly overcast and soon an electric storm was raging. The sky darkened and the wind came in puffs of hurricane violence. An attempt was made to turn the ship northward but it was too late to escape the storm. In a very few minutes an immense black funnel cloud went swirling by, striking terror into every one aboard. There was an awful roar and the water seemed to be sucked from the ocean up to a height of 300 feet. Had the *Fairfield* been in the path of the waterspout she might have been destroyed in a twinkling. An hour after the waterspout passed the sun was shining and the ship was sailing through a peaceful sea as though nothing had happened. The vessel was in the most violent part of the storm for about forty minutes.

PHOTOGRAPHS OF METEOROLOGICAL PHENOMENA.

The Weather Bureau has received from Mr. S. B. Strong, voluntary observer at Setauket, N. Y., a small photograph of the parhelia observed at that place on February 2, 1898, at 4:50 p. m. It is very interesting to find that not only the mock sun, but even the vertical and horizontal bands of light and a portion of the circular halos can be traced on this picture, and Mr. Strong's success in this work leads us to encourage other amateur photographers to attempt to preserve similar beautiful optical phenomena that are especially frequent at our western stations. But, in order to make these photographs of any use in the investigation of the halo phenomena, it will be necessary for the observer to devise some way by which to secure on this same plate some means of making accurate observations of the apparent angular distances. For instance, the present photograph shows the mock sun located about an inch and three-quarters to the right of the real sun. If we knew that the camera was pointed midway between the two, and that the focal length of the lens was about three inches, then we might figure out that the apparent angular bearing of the mock sun was about 30° to the right of the true sun. The photograph also shows both these suns elevated about one-third of an inch above the hills in the distant horizon, which we may figure out to be equivalent to an apparent angular altitude of about 10°. But what the meteorologist wants is the angular altitude above the true horizon below these hills, and the angular distance between the true sun and the mock sun; in fact, all the measurements relating to halos and parhelic circles must be given in angles. An ordinary photograph is merely a good witness to the fact that a halo occurred; it must be accompanied by some basis for angular measurements before it can be of any further use to the meteorologist. A common method of accomplishing this object consists in placing in front of the camera a framework of wires stretched at right angles to each other and so placed that one set is strictly horizontal and the other vertical. The intersection of the middle wires on the frame should be directly in front of the camera, and be photographed in the middle of the plate when the axis of the camera is exactly horizontal, as determined by a spirit level or plumb line. If we know the distance of the center of the wire frame from the optical center of the lens, we can easily calculate by trigonometry the angle subtended by the respective wires. If now, in this position, a photograph of the framework is taken on one of the plates that just fits into the plate holder, we find the latter covered by the pictures of the wires intersecting each other in a network. In general, the images of the wires will not appear straight but slightly curved, depending upon the lens that is used. Nevertheless, we know that every point along any one of the horizontal wires is at a known distance above or below the center of the plate and every point on any one of the vertical wires is at a known angular distance to the right or left of the center. Such a plate as this negative can now be preserved for future use. Whenever a landscape is photographed and measurements are desired the negative containing this network of lines is laid upon the landscape negative and a print of the two combined is taken, on which measurements of angular distances can be made with ease.

When this method is to be applied to clouds or other objects where the axis of the camera must be tilted upward, it is convenient to attach the camera, as a whole, to some altitude and azimuth instrument. If this is done with great accuracy it constitutes the apparatus known as "the photogrammeter" which has been much used during the past few years in the international cloud work. This apparatus becomes rather expensive when well made, but is universally applicable to photography of clouds, halo phenomena, waterspouts and tornado clouds, meteors or shooting stars, flying birds, kite work, and to sketches—we regret not to be able to say photographs—of the aurora borealis and the zodiacal light. It is evident, therefore, that our voluntary observers who possess cameras will contribute to exact meteorology in proportion as they obtain the additional equipment needed to attain accurate angular measurements.

GREENWICH NOON.

A voluntary observer, referring to a paragraph in the MONTHLY WEATHER REVIEW for August, 1897, and which has been repeated in the introduction to succeeding REVIEWS, inquires: "When it is 12 o'clock noon at Greenwich, is it then exactly 7 o'clock a. m. at stations 75° west of Greenwich?" To this question we answer, "Yes." Every 15° of longitude corresponds to one hour of time. The earth rotates on its axis—that is to say, any point describes a small circle of latitude around the earth's axis, or 360° in twenty-four hours, or at the rate of 15° per hour. When the Greenwich meridian passes through the sun, that is to say, when it is "mean noon" at Greenwich, then a station like Philadelphia, 75° west of Greenwich, is still five hours distant from the sun, and has